being unpatentable over *Ritter WO 96/37544* in view of *Krishnan et al. U.S. Patent No. 5,500,465* (newly cited).

The present invention is directed to an organosilicate with a homogeneous structure consisting of saponified PVAc with bound silicate structures, water and catalytic residue (Glycerol).

The process of the invention includes the production of the organosilicate in a watery dispersion, wherein the water does not prevent the total completion of the reaction. A minimum amount of water is necessary for carrying out the process in a stirred batch reactor. The water content of the initial substance is 50%-70%. Production can occur in an intensively mixed and sheared blend (watery dispersion) in a stirring reactor, with a low viscosity mixture (like water). Shearing forces are low due to the low viscosity and due to the nature of the apparatus. Information about the sheared blend will make it clear that the dispersion structure must be maintained during the reaction. The claimed "presaponifying" process step creates a novel and nonobvious process and results in the claimed unique product.

A result of the reaction is a watery dispersion, wherein the dispersed particles consist of homogeneous organosilicate in which 30% to 85% of the PVAc used is hydrolyzed.

It is possible to modify the claimed organosilicates through the addition of an organofunctional silane as part of the reaction mixture. The silanes contain polar organofunctional groups like a glycidyl group and a hydrolyzable alkoxy group. Thus they are no longer present in the product, but rather have brought the chemical reaction to completion. This is evident when the hydrolyzable substances are processed in a watery medium. Hence these silanes are also not contained in the starch blends that are produced with the addition of organosilicates.

The purpose of the organosilicates in accordance with the invention is their use as a compatibility agent in the polymer blends of thermoplastic starch and nonabsorbent polymers. The component makes possible the production of water durable polymer blends of TPS and water resistant polymers with high mechanical strength despite a starch content > 50%. The water content in the mixture of the initial substance is 10% to 20%. The water content in the finished polymer blend is 6% to 12%. This characteristic causes the occurrence of a stabile continual blend morphology, which can only be achieved through the addition of the organosilicate according to the present invention.

The primary reference *WO 96/37544 (RITTER)* discloses a complex mixture of PVAc/PVOH, water and insoluble silicates as filler.

The production with a limited amount of water is to promote the reaction, forming the water insoluble silicate and therefore water must be removed. The water content of the used complex mixtures is 8% - 25% (Claim 8).

The production which occurs under strong shearing forces takes place in a synchronized twin-screw extruder (example 1) in a highly viscous mixture (similar to bread dough). These shearing forces are very high due to the high viscosity and due to the nature of the apparatus.

The result is a nonhomogeneous thermoplastic mass, where the silicate is heterogeneously dispersed within the mass and not chemically bound. No information is disclosed about the saponification factor achieved. Experimentally a very low saponification factor of 10% was determined. Silanes are not disclosed. The production of biodegradable molded padding with increased waterproof qualities, means that the addition of the product to thermoplastic starch increases its waterproof qualities.

The patent *WO 96/37544 (Ritter)* uses by accident similar raw materials but the result is completely different due to different amounts of reactants and different processing conditions. The reaction carried out in an extruder is a short time reaction with residence times in the order of a minute compared with hours in the claimed process. It is a diffusion controlled reaction in a highly viscous fluid with poor conversion compared with the reaction yielding the component in the claimed process carried out in a low viscosity suspension with a large surplus of water with stoichiometric conversion. Therefore the properties of the resulting material are completely different, in particular the product from *Ritter's* patent cannot be used as compatibilizer but generates a thermoplastic polymer.

The secondary reference *US 5,500,465 (KRISHNAN)* discloses a polymer blend of unmodified polysaccharide softeners, and one or several nonabsorbent aliphatic polyesters and thus is completely different from the present invention. An extrusion process is used for the production of the polymer blends.

Krishnan in column 2 in lines 56 to 62 discloses that silanes are used for the surface coating of starchy films and molded padding in order to make these nonabsorbent and accordingly to form a water vapor barrier layer. The silanes are

drastically different in their structure from those claimed in the present invention. For the purpose of making the surface nonabsorbent the silanes must feature at least one nonabsorbent, i.e., nonpolar group.

The applied silanes or the resulting product in no way influence the structural formation of the polymer blends.

The polymer blends described in *Krishnan* are fundamentally different from those that are produced by the process claimed in the present invention. Water content of the initial starch <1% is necessary since otherwise, under these conditions a molecular decomposition of the polyester will occur with the loss of mechanical characteristics. The starch content is limited since it must be dispersed in the polyester.

As it can be seen from the above discussion of these prior art references, a combination of the teachings of these patents does not suggest the claimed invention. In particular the compatibilizer mentioned in the patent to *Krishnan* is chemically completely different from *Ritter* and consequently is not combinable therewith.

The compatibilizer is solely adapted to the starch/polyester blend, whereas the claimed component is a prefabricated compatibilizer with more general features and hence applicable for blends of hydrophilic polymers, for example starch but others as well, and hydrophobic polymers like polyester but also like starch acetate as it has been proved by the claimed invention. In more general terms a starch blend disclosed by *Krishnan* contains a different compatibilizer and is contrary to the claimed component. Both prior art *Krishnan* and *Ritter* patents have nothing in common apart from the fact that a compatibilizer is used.

Furthermore, neither *Krishnan* nor *Ritter* teach, suggest or disclose the concept of "presaponifying" which is recited by claim 20 and by claim 26.

Enclosed herewith is a Comparison Table that provides a side-by-side presentation of the patentable differences for the present invention relative to *Ritter* and *Krishnan*.

For all these reasons, the present invention, and all the claims, are patentable under 35 U.S.C. 103 over the prior art

references applied by the Patent Examiner. A prompt notification of allowability is respectfully requested.

Respectfully submitted,
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Enclosure: (1) Copy of Petition for Three Month Extension of Time-Small Entity, Check for $ 460.00;
(2) Comparison Table of Prior Art.

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Assistant Commissioner of Patents, Washington, D.C. 20231, on October 2, 2002.

Lisa L. Vulpis

Comparison of the claims of US 09/403,557 (BIOP) with WO 96/37544 (Ritter) and US 5,500,465 (Krishnan)

US 09/403,557 (BIOP)	WO 96/37544 (Ritter)	US 5,500,465 (Krishnan)
Subject is the synthesis of a **homogeneous compatiblizer** for combining hydrophilic with hydrophobic polymers by saponification of PVAc with water glass and/or alkali	**Subject** is a **multi component heterogeneous mixture** consisting of PCAc and PVOH (produced by partial saponification of PVAc) and water insoluble silicates	**Subject** is a **polymer blend** consisting of unmodified polysaccharide, plasticiser, synthetic co-polymer as compatibilizer and hydrophobic polyester
Claimed is a an innovative organo-silicate, it has a homogeneous structure consisting of PVAc-PVOH with chemically bound silicate structures and is processed by partial saponification of PVAc with water-glass	**Claimed is a PVAc/PVOH-silicate mixture** to be used as such or mixed with starch to improve its water stability	**Claimed is a polysaccharide/polyester blend** with improved water stability
Processing of the organo-silicate in a aqueous dispersion of PVAc, water glass and/or alkali, a water of 50 to 70 % is essential for the reaction carried out in an stirred-tank reactor	**Processing of the PVAc/PVOH-silicate mixture reduced amount of water (8 to 25**%) in an extruder, for the formation of water insoluble silicates the water content must be reduced	**Processing of the blend in an extruder**
Processing of the organo-silicate **in an intensively agitated stirred-tank reactor** - low viscous reaction mixture (aqueous dispersion), - shear stress is low (low viscosity, stirred-tank)	**Processing** of the mixture in the presence of strong shear stress **in co-rotating double-screw extruders** - -high viscous mixture (viscosity comparable to bread dough), - shear stress very high (high viscosity)	**Processing** of the blend in the presence of strong shear stress **in co-rotating double-screw extruders**
Product of a reaction is a aqueous suspension whereby the organo silicate consists of the suspended particles - -long reaction time (1 to 2 hours), - stoichoimetric saponification of water glass and/or alkali to organo-silicate structure with functional OH- and COOH-groups working as compatibilizer	**Product is an inhomogeneous thermoplastic material whereby the silicates are heterogeneously dispersed and are not chemically bound** - short reaction time (< 1 min), - only partial saponification of PVAc (< 10 %), - saponification is not adjustable due to short residence time in extruder	**Product is a blend, in particular a starch/polyester blend** with a co-polymer like polycaprolactone-co-maleic anhydride as a compatilizer

- saponification is adjustable between 20-85 % , according to necessary properties of compatibizer 50 % are preferred		
Modification of organo-silicate by the addition of an organo-functional silane into the reaction mixture, the silanes contain polar organo-functional groups like glycidyl- or hydrolyzable alkoxy-groups - consequently they are not any more present in the product because the reaction takes place in an aqueous environment, - silanes are therefore not present in starch blends compounded with organo-silicates as compatibilizer	**Silanes are not mentioned in the patent**	**Silanes and derived products do not influence the formation of the structure of the polymer blend**. Silanes are used as coating for starch containing films and injection moulded parts for hydrophobicity purposes or to form a barrier layer for water vapour. Silanes suitable for such applications are different in its structure compared to those described in the BIOP patent. For hydrophobing purposes the silanes must contain hydrophobic, e.g. non-polar group
The organo-silicate in accordance with the patent has its field of application as a compatibilizer in polymer blends of hydrophilic polymers like starch and hydrophobic polymers like polyesters or starch acetate	**Biodegradable extruded parts of PVAc/PVOH-silicate mixture as such or as blends with starch** with improved water stability	**Polymer blend made from polysaccharide and polyester** in the presence of a co-polyester as compatibilizer
The component renders possible the production of water stable polymer blends from starch and other hydrophilic polymers and hydrophobic polymers like polyester and starch acetate with excellent mechanical properties - starch content > 50 %, - water content > 15 % (mixture prior extrusion) - water content < 12 % in final blend. These properties are caused by a stable bi-continuous blend morphology, which can be	**Application fields restricted due to inhomoge-neous mixture** and direct accessibility of water to the starch, no long time water stability	**Polymer blends in principle different from those accessible with BIOP component as compatibilizer** - water content of starch < 1 % is necessary, at higher water content molecular degradation of the polyester would occur with severe reduction of the mechanical properties of the blend, - the starch content is restricted, since it is dispersed in polyester

only reached with the claimed organo-silicate.		